

Features

- Low voltage operation
- Low current consumption
- Miniature SMD package size
- I²C communication protocol
- Reliable capacitive technology
- Relative humidity accuracy of ±2 % (Typical)

Applications

Industrial:

- HVAC systems
- Process monitoring
- Packaging automation
- **Medical Devices (low/medium risk):
- Diagnostic equipment
- Analysis equipment

BPS230 Series - 2 mm Humidity Sensor

Absolute Maximum Ratings	
Supply Voltage (V _{CC})	0.3 to 7.0 V
nput Voltage (V _I)	
CE	
SCL/SDA	
Dutput Voltage (VO)	0.3 to V _{CC} + 0.3 \
Hi-level Output Current (IOH) 1 Terminal	E m/
All Terminals Total	
ow-level Output Current (IOL)	-20 111/
1 Terminal	5 m/
All Terminals Total	
Operating Temperature (T _a)	
Storage Temperature (T _{stg})	
Recommended Operating Conditions	
Power Supply Voltage (V _{CC})	1.62 to 5.5 VD(
Capacitance between V_{cc} and V_{ss} (C_p)	0.1 µF typica
rull Up Resistor Value on SDA1 (R1)	
Pull Up Resistor Value on SCL1 (R2)	
Select the resistance value to meet AC characteristics.	
Electrical Characteristics	
Humidity Detection	0.1400.0/. DU
Measurement Range	
Resolution (10-bit)	
Humidity Accuracy - Typical (see Humidity Sensor Accuracy Graph for Maximum Rating)	,,
Humidity Accuracy - Typical (see Humidity Sensor Accuracy Graph for Maximum Rating) @ 25 °C (20 to 80 % RH)	±2 % RI
Humidity Accuracy - Typical (see Humidity Sensor Accuracy Graph for Maximum Rating) @ 25 °C (20 to 80 % RH) @ 5 °C to 45 °C (0 to 100 % RH)	±2 % Rt±4 % Rt.
Humidity Accuracy - Typical (see Humidity Sensor Accuracy Graph for Maximum Rating) @ 25 °C (20 to 80 % RH) @ 5 °C to 45 °C (0 to 100 % RH) Hysteresis @ 5 °C to 45 °C (0 to 100 % RH)	±2 % Rt±4 % Rt.
Humidity Accuracy - Typical (see Humidity Sensor Accuracy Graph for Maximum Rating) @ 25 °C (20 to 80 % RH) @ 5 °C to 45 °C (0 to 100 % RH)	±2 % RI ±4 % RI ±4 % RI ±1 % RH typica
Humidity Accuracy - Typical (see Humidity Sensor Accuracy Graph for Maximum Rating) @ 25 °C (20 to 80 % RH) @ 5 °C to 45 °C (0 to 100 % RH) Hysteresis @ 5 °C to 45 °C (0 to 100 % RH) Response Time Reach (τ 63 % @ 25 °C, wind velocity @ 1.0 m/s)	±2 % RI ±4 % RI ±4 % RI ±1 % RH typica
Humidity Accuracy - Typical (see Humidity Sensor Accuracy Graph for Maximum Rating) @ 25 °C (20 to 80 % RH)	±2 % RI ±4 % RI ±1 % RH typica 8 second
Humidity Accuracy - Typical (see Humidity Sensor Accuracy Graph for Maximum Rating) @ 25 °C (20 to 80 % RH) @ 5 °C to 45 °C (0 to 100 % RH) Hysteresis @ 5 °C to 45 °C (0 to 100 % RH) Response Time Reach (τ 63 % @ 25 °C, wind velocity @ 1.0 m/s) Inless otherwise specified: V _{CC} = 1.62 to 5.5 V, V _{SS} = 0 V, T _a = -20 °C to 100 °C	±2 % RI ±4 % RI ±1 % RH typica 8 second
Humidity Accuracy - Typical (see Humidity Sensor Accuracy Graph for Maximum Rating) @ 25 °C (20 to 80 % RH)	±2 % RI ±4 % RI ±1 % RH typica 8 seconds -30 °C to +100 °C (-22 °F to +212 °F
Humidity Accuracy - Typical (see Humidity Sensor Accuracy Graph for Maximum Rating) @ 25 °C (20 to 80 % RH)	±2 % RI ±4 % RI ±1 % RH typica 8 seconds -30 °C to +100 °C (-22 °F to +212 °F
Humidity Accuracy - Typical (see Humidity Sensor Accuracy Graph for Maximum Rating) @ $25 ^{\circ}\text{C}$ (20 to $80 ^{\circ}\text{RH}$)	±2 % RI ±4 % RI ±1 % RH typica 8 seconds -30 °C to +100 °C (-22 °F to +212 °F
Humidity Accuracy - Typical (see Humidity Sensor Accuracy Graph for Maximum Rating) @ 25 °C (20 to 80 % RH)	#2 % RF #4 % RF #4 % RF #1 % RH typica 8 second -30 °C to +100 °C (-22 °F to +212 °F -0.1 °C (0.18 °F -0.4 °C (0.72 °F
Humidity Accuracy - Typical (see Humidity Sensor Accuracy Graph for Maximum Rating) @ 25 °C (20 to 80 % RH)	#2 % Ri #4 % Ri #4 % Ri #1 % RH typica 8 second -30 °C to +100 °C (-22 °F to +212 °F -0.1 °C (0.18 °F -0.4 °C (0.72 °F # 0.4 °C (±0.72 °F
Humidity Accuracy - Typical (see Humidity Sensor Accuracy Graph for Maximum Rating) @ 25 °C (20 to 80 % RH) @ 5 °C to 45 °C (0 to 100 % RH) Hysteresis @ 5 °C to 45 °C (0 to 100 % RH) Response Time Reach (τ 63 % @ 25 °C, wind velocity @ 1.0 m/s) Unless otherwise specified: V _{CC} = 1.62 to 5.5 V, V _{SS} = 0 V, T _a = -20 °C to 100 °C Temperature Detection Measurement Range Resolution (11 bit) -10 °C to +70 °C All other temperatures Temperature Accuracy @ 5 °C to 60 °C @ -20 °C to 85 °C.	#2 % RF #4 % RF #4 % RF #1 % RH typica 8 second -30 °C to +100 °C (-22 °F to +212 °F #5
Humidity Accuracy - Typical (see Humidity Sensor Accuracy Graph for Maximum Rating) @ 25 °C (20 to 80 % RH)	#2 % RF #4 % RF #4 % RF #1 % RH typica 8 seconds -30 °C to +100 °C (-22 °F to +212 °F -0.1 °C (0.18 °F -0.4 °C (0.72 °F #1.0 °C (±0.72 °F #1.0 °C (±1.8 °F
Humidity Accuracy - Typical (see Humidity Sensor Accuracy Graph for Maximum Rating) @ 25 °C (20 to 80 % RH) @ 5 °C to 45 °C (0 to 100 % RH) Hysteresis @ 5 °C to 45 °C (0 to 100 % RH) Response Time Reach (τ 63 % @ 25 °C, wind velocity @ 1.0 m/s) Unless otherwise specified: V _{CC} = 1.62 to 5.5 V, V _{SS} = 0 V, T _a = -20 °C to 100 °C Temperature Detection Measurement Range Resolution (11 bit) -10 °C to +70 °C All other temperatures Temperature Accuracy @ 5 °C to 60 °C @ -20 °C to 85 °C.	#2 % RF #4 % RF #4 % RF #5 1 % RH typica 8 seconds #6 0.1 °C (0.18 °F #7 0.4 °C (0.72 °F #7 0.4 °C (±0.72 °F #7 1.0 °C (±1.8 °F #7 0.1 °C (±0.18 °F #7 0.1 °C (±0.18 °F

Unless otherwise specified: V_{CC} = 1.62 to 5.5 V, V_{SS} = 0 V, T_a = -30 °C to 100 °C

NOTE 1 Extended exposure to >90 % RH causes a shift of up to 3 % RH which is reversible after a period of 14 days.

Current Consumption

Unless otherwise specified: V_{CC} = 1.62 to 5.5 V, V_{SS} = 0 V, T_a = 0 °C to 60 °C

- RoHS3 Directive 2015/863 Amendments of Annex II on March 31, 2015
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Specifications are subject to change without notice.

Users should verify actual device performance in their specific applications.

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Input/Output Terminal Characteristics

Unless otherwise specified: V_{CC} = 1.62 to 5.5 V, V_{SS} = 0 V, T_a = -30 °C to 100 °C

Product Characteristics

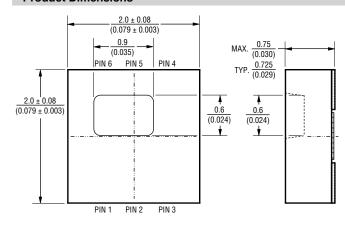
 Moisture Sensitivity Level
 1

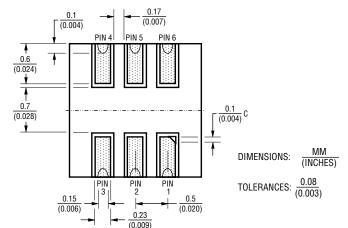
 ESD Classification (HBM)
 1 kV

 Marking
 3,000 pcs. per 13-inch reel

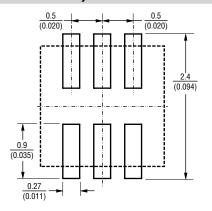
 Weight
 0.059 grams (0.002 oz)

Product Dimensions





Recommended PCB Layout



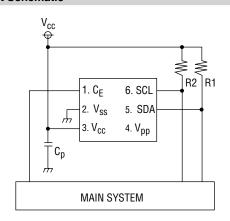
Terminal Assignment

No.	Terminal Name	Function
1	CE	Chip enable terminal
2	V_{ss}	Power supply terminal (-)
3	V_{cc}	Power supply terminal (+)
4	NC	No connection
5	SDA	I ² C serial data
6	SCL	I ² C serial clock

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Users should verify actual device performance in their specific applications.

Basic Circuit Schematic



C_p 0.1 μF R1 5k Ω R2 $5k \Omega$

NOTE: R1 and R2 are reference values. Resistor values should be selected to meet the AC characteristics.

Operation Mode

Operation	Terminal Setup	Operation State of Each Functional Block						
Mode	Mode CE		Power Supply	Oscillation	Temp. Detection	Capacitance Detection	OTP Memory	I ² C-Bus
Sleep *1	0	NC	Stop	Stop	Stop	Stop	Stop	Stop
Standby	1	NC	Operation	Operation	Stop	Stop	Read-out Possible	Operation

^{*1} In case of power control mode, there is no sleep operation. I²C slave address (SADR) is defined as "111 1111" (7Fh).

Control Register Map

Address	Bit	Bit Name	Function	Value	ReadOut	Write-In	R/W	Init.
	D7-1	-	Reserved	-			R	0
00h	D0	RESET	Reset	0	Normal Operation	None	R/W	0
				1	-	Reset Action		
	D7-6	MANMODE	Manual Detection Mode	00	Normal Operation Mode			0
			value Avg.	000	No Averaging Process		R/W	
	DE 0	D5-3 HAVE[2:0]		001	2 Times Average Mode			
01h	D5-3			01x	4 Times Average Mode			
			Mode	1xx	8 Times Average Mode			
	D2 TAVE	Temperature	0	8 Times Average Mode				
		TAVE Detection Value Avg. Mode	1	16 Times Average Mode		R/W	0	

Control Register Map (Continued)

Address	Bit	Bit Name	Function	Value	ReadOut	Write-In	R/W	Init.
	D1	-	Reserved	-			R	0
01h	DO	MAN	Manual	0	Standby State	Detection Operation Stop	B/W	0
	D0	IVIAIN	Mode	1 De	Under Detection Operation	Detection Operation Start	II/ VV	U
	D7-1	-	Reserved	-			R	0
03h	D0	FDD	Manual	0	No Error	Nothing is Done		
	D0	ERR	Detection Error Flag	1	Error Occurred	Error Flag Reset	R/W	0
04h	D7-0	HC[7:0]	Humidity Detection Result (After Correction Operation)		000h-3FFh		R	Х
	D7-2	-	Reserved	-			R	0
05h	D1-0	HC[9:8]	Humidity Detection Result (After Correction Operation)				R	х
06h	D7-0	TC[7:0]	Temperature Detection Result (After Correction Operation)		000h-7FFh		R	Х
	D7-3	-	Reserved	-			R	0
07h	D2-0	TC[10:8]	Temperature Detection Result (After Correction Operation)				R	х
0Ah	D7-0	K[7:0]	Capacity Detection Result (Before Correction Operation)		000h-FFFFh		R	0

Control Register Map (Continued)

Address	Bit	Bit Name	Function	Value	ReadOut	Write-In	R/W	Init.
0Bh	D7-0	K[15:8]	Capacity Detection Result (Before Correction Operation)			R	0	
	D7-5	-	Reserved	-	-	-	R	0
			Standard	0	Outside Cap	acity Cutting		
2Ch	D4	D4 SCR_ON_R	Capacity Connection Control	1 Outside Capacity Connection		R/W	0	
	D3-0	SCI_ ON_R[3:0]	Internal Capacity Connection Control	0h~Fh x 0.6 pF Example: At the time of 8 hours, access to internal capacity of 4.8 pF		R/W	Х	
	D7-1	-	Reserved	-		R	0	
03h	D0 ERR		Manual Detection Error Flag	0	No Error	Nothing is Done		
		ERR		1	Error Occurred	Error Flag Reset	R/W	0

Transfer Function Formula

Humidity

RH =
$$\frac{100}{2^{10}}$$
 x RH_{IC} (0 ~ 100 % RH)

RH_{IC}: IC Humidity Output Data (10 bit)

Refer to Register Map:

 RH_{IC} = Data of the addresses 04H and 05H (000h ~ 3FFh) It changes into a decimal and is operation.

Temperature

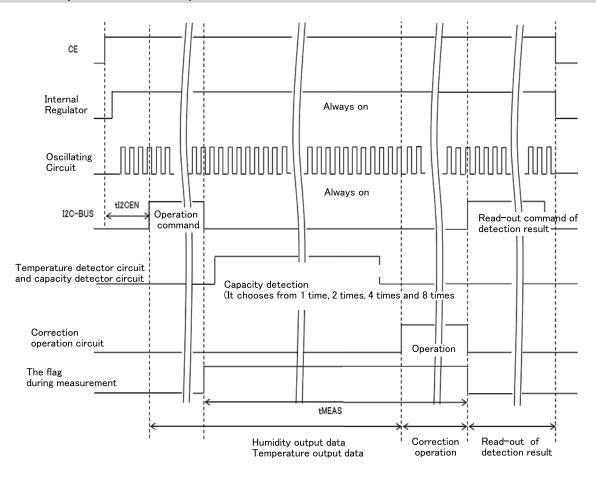
T =
$$[T_{IC} - (2^{10} - \frac{25}{0.1})] \times 0.1$$
 (-30 ~ 100 °C)

T_{IC}: IC Temperature Output Data (11 bit)

Refer to Register Map:

 T_{IC} = Data of the addresses 06H and 07H (000h ~ 7FFh) It changes into a decimal and is operation.

Capacitance/Temperature Detection Sequence

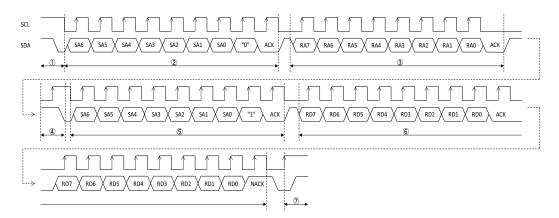


How To Order BPS230 - D 3P0 - S 10 E Model Series Humidity-Temperature Sensor Output Type D = Digital Accuracy (% RH) 3P0 = ±3.0 Moisture Sensitivity S = Standard Resolution 10 = 10-bit Packaging Designator E = 3000 pcs. per 7-inch Reel

Output Type Waveform and Data Read/Write Procedure

I²C-BUS Data Read-out Procedure

- (1) I²C master device releases START condition.
- ig(2ig) I2C master device transmits slave address and WRITE mode selection.
- (3) I²C master device transmits register address of this IC.
- (4) I²C master device releases repeated START condition. (Release method is same as START condition.)
- (5) I²C master device again transmits slave address and READ mode selection. (Read mode can be selected by transmitting "1" in 8th bit.)
- 6 I2C master device reads-out data from register address designated at ③.
 It is possible to read-out data while register address increments one, by reading-out multiple data continuously. However, during continuous read-out, please return ACK to this IC as a reply of master.
- 7) After the completion of all read-out, I²C master device releases STOP condition.



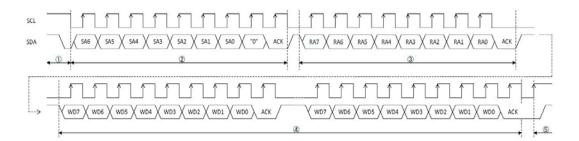
~ Continued ~

Output Type Waveform and Data Read/Write Procedure (Continued)

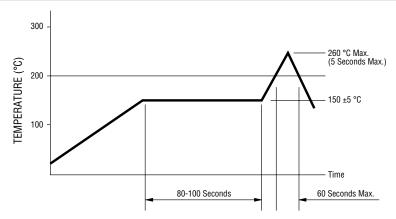
I2C-BUS Data Write-in Procedure

- (1) I²C master device releases START condition. (Start condition can be released by changing SDA from "H" to "L" while SCL is in "H" state.)
- 2 I²C master device transmits slave address and WRITE mode selection. (Write mode can be selected by transmitting "0" in 8th bit while 1~7th bits are slave address.)
- (3) I²C master device transmits register address of this IC.
- (4) I²C master device transmits write-in data.
- (5) It is possible to write-in data while register address increments one, by transmitting multiple write-in data continuously.

After the completion of transmitting all write-in data, I²C master device releases stop condition. (Stop condition can be released by changing SDA from "L" to "H" while SCL is in "H" state.)



Solder Profile



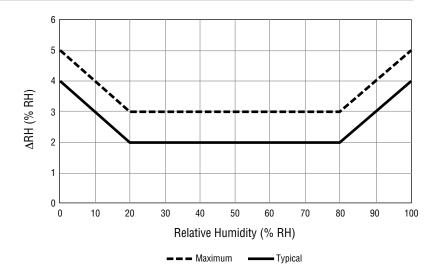
Processing Method: Reflow soldering with infrared heat or forced air convection (only once).

Notes:

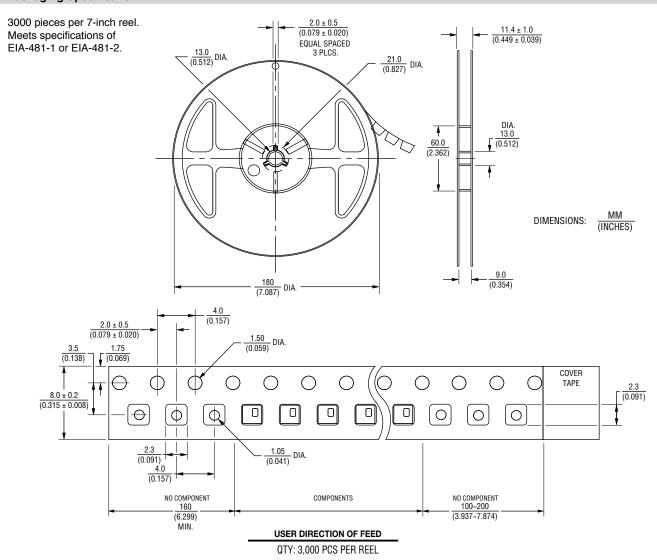
- 1. No clean solder paste is recommended.
- 2. Aqueous wash is not recommended.
- Use of water soluble soldering flux should be avoided due to possible corrosion.
- 4. Multiple passes through the soldering process is not recommended.
- 5. Other SMD processes and profiles should be verified by the customer.

Humidity Sensor Accuracy

Relative Humidity (% RH)	Maximum	Typical
0	5	4
10	4	3
20	3	2
30	3	2
40	3	2
50	3	2
60	3	2
70	3	2
80	3	2
90	4	3
100	5	4



Packaging Specification



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OOO «ЛайфЭлектроникс" "LifeElectronics" LLC

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- Оценку стоимости проекта по компонентам.
- Изготовление тестовой платы монтаж и пусконаладочные работы.



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